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Review

Home-Based Physiotherapy and Rehabilitation in Patients with Idiopathic Pulmonary Fibrosis: A Review

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Abstract

The objective of the study is to review the studies on home-based pulmonary rehabilitation practices in idiopathic pulmonary fibrosis patients in the last 5 years. Home-based randomized controlled trials in idiopathic pulmonary fibrosis patients published in the PubMed database within the previous 5 years were searched. As a result of the research, a total of 5 articles were included in the study. Five home-based rehabilitation practices used in these articles were reached. Totally, 176 patients were found to have participated in these programs. As a result, patients who have difficulty accessing hospital-based rehabilitation services due to various reasons will benefit from home-based rehabilitation services. However, the content of the home-based program and the method of follow-up and supervision affect the results.

KEYWORDS: Home-based rehabilitation, idiopathic pulmonary fibrosis, pulmonary rehabilitation
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INTRODUCTION

Idiopathic pulmonary fibrosis (IPF), one of the forms of interstitial pneumonia, is a chronic disease. It is characterized by progressive alveolar interstitium fibrosis, causing permanent lung damage, generally seen in advanced ages, and with a poor prognosis.[1] Idiopathic pulmonary fibrosis causes severe mortality and morbidity in patients, and the life expectancy after diagnosis is approximately 3-5 years.[2] In the literature, the incidence of IPF varies between 0.22 and 16 per 100 000 individuals.[3-5] To diagnose IPF, other idiopathic interstitial pneumonia, autoimmune diseases, drugs, and occupational and environmental causes that can make the unusual interstitial pneumonia pattern should be excluded.[2] In the clinical picture of IPF patients, advanced progressive dyspnea, cough, deterioration in pulmonary function, and recurrent coughs are frequently observed. All these symptoms cause fatigue and a decrease in exercise capacity, sleep capacity, and participation in activities of daily living. As a result, depression, anxiety, dissatisfaction with life, and emotional disorders occur in IPF patients, and their quality of life deteriorates over time.[6]

Idiopathic pulmonary fibrosis treatment aims to improve the patient's symptoms and health status, protect lung function, reduce oxygen demand, reduce the frequency of acute exacerbations, and increase the patient's quality of life.[7] Treatment applications based on symptom management consist of pharmacological management, rehabilitation applications, palliative care, and transplantation.[8] Lung transplantation is preferred in patients who do not respond to medical treatment.[9] Pharmacological management consists of antifibrotic drugs used to reduce disease progression and functional losses, antacid therapy drugs, steroid-based drugs used in cough management, and bronchodilators.[10,11] In addition, rehabilitation practices, including patient education, exercise training, respiratory therapy, smoking cessation, and psychosocial support, are of great importance in symptom management.[12]

It has been shown in the literature that a decrease in respiratory rate, an increase in tidal volume and oxygen saturation, an improvement in cardiac capacity, an increase in quadriceps fatigue resistance, an increase in the efficiency of skeletal muscle function at the cellular and molecular levels, and an improvement in dyspnea, exercise capacity, and quality of life are observed with pulmonary rehabilitation applications.[13-15] Endurance exercises, resistance exercises, neuromuscular electrical stimulation (NMES) applications, respiratory muscle training, energy conservation techniques, tai chi, and whole-body vibration training methods can be used in IPF rehabilitation.[16] In the literature, it has been suggested that endurance exercises, which can be done in the form of cycling, walking, treadmill, climbing stairs, and combinations of all these, should be performed at 60%-70% of the maximum working capacity for at least 20 minutes 3-5 times a week in IPF patients. In addition, it will be safe to give oxygen support during exercise.[17,18] For strengthening exercises, high-intensity interval training is recommended for this patient group. In addition to all these, stretching and stretching exercises, and lower and upper extremity exercises can be performed.[18]

The positive effects of pulmonary rehabilitation programs on functional outcome parameters such as dyspnea, exercise capacity, and health-related quality of life have been investigated and proven mostly in patients with chronic

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obstructive pulmonary disease (COPD). However, it has been accepted that exercise programs should be adapted to the daily life of the patient in order to maintain the positive effects of the supervised pulmonary rehabilitation program.[19] Home-based programs are a viable option for pulmonary rehabilitation in daily life. In addition, these programs are effective, useful, simple, inexpensive, practical, and equivalent to inpatient/outpatient treatment programs.[20]

This study aims to review the studies on home-based pulmonary rehabilitation practices in IPF patients in the last 5 years.

MATERIAL AND METHODS

In this review, research was conducted on the studies conducted in the last 5 years in the PubMed database. While conducting the investigation, the keywords "Idiopathic Pulmonary Fibrosis and Rehabilitation," "Idiopathic Pulmonary Fibrosis and Exercise," and "Idiopathic Pulmonary Fibrosis and Home-Based Rehabilitation" were used. No limits were set in terms of age and gender in the study, but randomized controlled studies were examined.

Inclusion Criteria

It was determined that the study was published in the last 5 years and was in a randomized controlled study design, only IPF patients were included, and it was conducted only on home-based pulmonary rehabilitation practices, the study language was English, and full-text access was available.

Exclusion Criteria

As the study's exclusion criteria, non-home-based studies that evaluate the effectiveness of practices other than pulmonary rehabilitation (transplantation, pharmacological therapy, oxygen therapy, etc.), include patients with different pathologies and focus on various pathologies other than symptoms of IPF patients.

MAIN POINTS

- There is a need for home-based rehabilitation programs in patients with idiopathic pulmonary fibrosis due to some reasons, such as difficulty in accessing rehabilitation services, risk of infection, and reduced and difficult mobility.
- Some of the home-based rehabilitation practices used in idiopathic pulmonary fibrosis rehabilitation are as follows: deep breathing exercises, telerehabilitation program, including physical exercises and a patient education program, a neuromuscular electrical stimulation application, walking bike use, and Wii exercise game applications.
- Regular follow-up of patients in home-based programs directly affects patient compliance and results.
- Patient compliance problems are more common in home-based rehabilitation programs that require materials.
- The literature on the effectiveness of home-based exercise programs in idiopathic pulmonary fibrosis patients is weak, and studies with different rehabilitation methods and study protocols are needed.

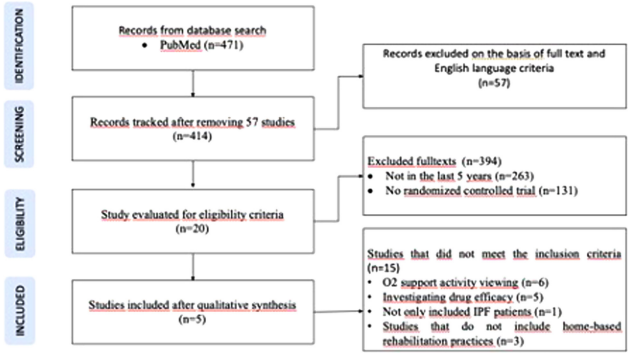

Figure 1. Flow chart showing the follow-up and inclusion process of the articles in the review.

RESULTS

As a result of this research, a total of 471 studies were reached. First, when non-full-text and non-English studies were excluded, the research continued with a total of 414 studies. Then, a total of 20 studies were selected according to the inclusion criteria of being a randomized controlled study published in the last 5 years. A total of 5 studies were included in the study by reading the full text of all these studies and considering the inclusion and exclusion criteria (Figure 1). A total of 176 patients participated in the included studies. The patient ages in the studies ranged from 65 to 77 years. A different home-based rehabilitation method was applied in all studies. These home-based rehabilitation practice studies include deep breathing exercises (n = 1), telerehabilitation programs, including physical exercises and patient education program applications (n = 1), NMES application (n = 1), walking bike using (n = 1), and Wii exergame program (n = 1). All studies were followed up with an exercise diary (n = 5).

Quality of life and functional performance were evaluated in all included studies. Exercise capacity was evaluated with the 6-minute walk test (6MWT) in 5 studies. Only 1 study evaluated the patients' 7-day pedometer data in addition to the 6MWT. St. George's Respiratory Questionnaire (SGRQ) was used for quality of life assessment in 4 studies and King's Short Interstitial Lung Disease Questionnaire (K-BILD) in 3 studies. Dyspnea was evaluated in only 1 of the studies, and the Borg scale was used in the evaluation. Only 1 study evaluated lung volume by x-ray. Respiratory function tests were performed in 3 studies. While forced vital capacity (FVC) and carbon monoxide diffusion capacity (DLCO) were measured in 2 studies, forced expiratory volume in the first second (FEV1) was measured in addition to these in 1 study. The main results of the study are given in Table 1.

DISCUSSION

The effectiveness of pulmonary rehabilitation practices in symptom management in IPF patients has been demonstrated in the literature.[13] The need for home-based rehabilitation programs is increasing due to reasons, such as difficulty in accessing rehabilitation services, risk of infection, and reduced and difficult mobility.[21] Especially during the pandemic, the arrival of respiratory patients to the clinical environment increases the risk of infection.[22] For these reasons,

Table 1. Design of Included Studies, Participant Characteristics, Evaluation, Intervention, and Outcome Characteristics

Author, Year, Country, Study Design	Patient Characteristics (Group, Number, Age, Gender Ratio (Male/Female), BMI (kg/m²))	Intervention	Duration and Frequency	Supervision of the Implemented Home Program	Outcome Measurement	Evaluation and Following Times	Outcomes	Total Number of Patients Completing the Study	Key Points
Shen et al[23], China, RCT	RG (n = 39), 65 ± 6, 37/2, 24 ± 3 CG (n = 43), 65 ± 8, 40/3, 25 ± 3	RG: deep breathing exercises from a video recording + current therapy CG: current therapy	12 months/ every day/3 times/9 minutes	• Via CD	• Lung volume (x-ray) • Respiratory function (FEV1, FVC, DLCO) • Quality of life (SGRQ) • Walking distance (6MWT) • ECG	• Beginning • Month 6 • Month 12	At 6 months: • FVC, FEV1, DLCO, and SGRQ results changed significantly in the exercise group • 6MWT was improved in the exercise group, but there was no significant difference between it and the control group. • In the 12th month, respiratory functions and quality of life outcomes were better in the exercise group • The decrease in walking distance was less in the exercise group	• Sixth month 30 patients • 12th month 59 patients • 6th and 12th months 20 patients	The number of acute exacerbations and mortality rates were found to be lower in the exercise group compared to the control group.
Cerdán-de-Las-Heras et al[24], Denmark, RCT	RG (n = 15), 70 ± 9, 13/2 CG (n = 14), 72 ± 8, 8/6,	RG: telerehabilitation (e-learning packages, correspondence sessions, physical exercises via the app) + ordinary care CG: ordinary care without rehabilitation	12 weeks/3-5 times a week/10-20 minutes	• Via VAPA App (first 3 months)	• Exercise capacity [6MWT, pedometer (7 days)] • Quality of life (SGRQ, K-BILD, GAD7) • Respiratory function tests (FVC, DLCO) • Telerehabilitation satisfaction survey • Weekly working days and hours	• Beginning • Month 3 • Month 6 • Month 9	High patient compliance, exercise capacity preserved No change in quality of life, pulmonary function tests and walking distance	• Third month 22 patients • Sixth month 22 patients • Ninth month 21 patients	A useful technology for a physically active lifestyle in IPF patients

(*Continued*)

Table 1. Design of Included Studies, Participant Characteristics, Evaluation, Intervention, and Outcome Characteristics (*Continued*)

Author, Year, Country, Study Design	Patient Characteristics (Group, Number, Age, Gender Ratio (Male/Female), BMI (kg/m²))	Intervention	Duration and Frequency	Supervision of the Implemented Home Program	Outcome Measurement	Evaluation and Following Times	Outcomes	Total Number of Patients Completing the Study	Key Points
Nolan et al[25], United Kingdom, RCT	RG (n = 11), 76, 7/4, 24.2 CG (n = 11), 77, 8/3, 25.2	RG: NMES (bilateral quadriceps) + home exercises CG: placebo NMES + home exercises	6 weeks/ every day/30 minutes	• Brochure • Manual • Introductory training (40 min) • Weekly Phone Call	• Exercise capacity (6MWT) • Functional performance (short physical performance battery) • Rectus femoris length • Quality of life (K-BILD) • Physical activity parameters (step count, sedentary time, 4 m walking speed)	• Beginning • Month 6 • Month 12	Patient compliance is poor At the end of the 12th week, an increase in the rectus femoris cross-sectional area, improvement in daily living activities related to self-care, decrease in sedentary time and increase in the time allocated to physical activity in the exercise group	• Sixth week 18 patients • 12th week 19 patients	Side effects associated with the use of NMES were seen in the study group. It was concluded that the study protocol was not suitable for the evaluation of NMES activity.
Wapenaar et al[26], Denmark, RCT (crossover)	RG: (n = 12) 71, 18/5 CG: (n = 11)	RG: walking bike + standard treatment CG: standard treatment + walking bike	8 weeks/ every day/60 min	• Initial training	• Respiratory function tests (FVC, DLCO) • Exercise capacity (6MWT, O_2 saturation, number of steps per day) • Quality of life (SGRQ, K-BILD, GAD-7, perceived quality of life scale)	• Beginning • Week 9 • Week 18	Poor applicability with a large number of patients, increase in quality of life, increase in mobility, no change in functional exercise capacity	• Eighth week 16 patients • 16th week Ten patients	Although it has been shown to be effective on quality of life, problems such as the suitability of environmental conditions, comfort of use, and unwillingness to use assistive devices have been reported in patient reports.
Yuen et al[27], United Kingdom, RCT	RG: (n = 10) 67 ± 7, 5/5, 28 ± 5 CG: (n = 10) 72 ± 8, 8/2, 28 ± 4	RG: Wii Fit exergames CG: Wii video games	12 weeks/3 days a week/30 minutes	• Follow-up by phone (1 per month)	• Functional capacity (6MWT) • Dyspnea (Borg scale) • Quality of life (SGRQ)	• Beginning • Week 12	Low rate of attendance (20%), deterioration in 6DKYT and SGRQ results in both groups, improvement in dyspnea score in the exercise play group	• 12th week 20 patients	–In the case group, 3 patients never used the exercise game, 5 patients used it for 9 weeks or more.

6MWT, 6 minutes walking test; BMI, body mass index; CG, control group; DLCO, carbon monoxide diffusion capacity; ECG, electrocardiogram; FVC, forced vital capacity; FEV1, forced expiratory volume in 1 second; GAD-7, Generalized Anxiety Disorder Scale; K-BILD, King's Brief Interstitial Lung Disease Questionnaire; NMES, neuromuscular electrical stimulation; RCT, randomized controlled trial; RG, rehabilitation group; SGRQ, St. George's Respiratory Questionnaire.

it is of great importance to evaluate and prove the effectiveness of home-based pulmonary rehabilitation studies.

In 2021, Shen et al[23], in a study conducted by 82 patients for a total of 12 months, the pulmonary rehabilitation approach, including basic breathing exercises, was found to be easy and cost-effective for IPF patients, and it was shown that it could help pulmonary rehabilitation. The patients were given a home program including deep breathing exercises 3 times a day. These exercises contain deep breath of whole lung, unilateral lower lung, and upper lung movement sets. At the end of the sixth month, the patients' respiratory functions and quality of life were improved, and at the end of the twelfth month, when compared with the control group, there was an improvement in lung volume and 6-minute walking test in addition to the parameters in the sixth month.[23]

In another study conducted by Cerdán-de-Las-Heras et al[24] in 2021, the effectiveness of telerehabilitation on exercise capacity in IPF patients was evaluated. This telerehabilitation study, which used video consultation, e-learning packages, correspondence sessions, VAPA application, working hours, and questionnaires, continued for 12 weeks under the guidance of a physiotherapist. Then the patients continued to use the application alone. Within the program, the patient was given training, and in the content of the exercise program, personalized weights, step board, and exercises with elastic bands were used. Exercise intensity is 10-20 minutes, 3-5 times a week, under the therapist's guidance. As a result of this study, the telerehabilitation program with the VAPA application was found to be beneficial for IPF patients. While the exercise capacity decreased in the control group from the beginning, it was preserved in the exercise group. However, there was no change in the quality of life and 7-day pedometer measurements. Patient compliance with telerehabilitation was found to be high, and so its use in IPF patients may be beneficial.[24]

In Nolan et al[25], 22 patients were included in the study, in which the effectiveness of NMES was applied to the quadriceps muscle in IPF patients. In addition to the personalized home-based exercise program for 6 weeks, the patients were given a home-based application of bilateral quadriceps stimulation to the quadriceps muscle for 30 minutes a day for 6 weeks with the Kneehab XP device. The patients were followed up by phone. At the end of the study, it was observed that the patients' compliance with the program was not good. At the end of the 12th week, it was observed that the time spent by the exercise group on physical activity was more than the control group.[25]

In Wapenaar et al[26], a study conducted in 2020, it was reported that a home-based exercise program with a walking bike was beneficial in IPF patients. The walk bike is an ambulation aid, a form of a bicycle but without pedals. In the study, it was shown that the exercise program applied using a walking bike for 1 hour a day for 8 weeks in 2 groups of 23 people provided a significant increase in the quality of life of IPF patients and increased the mobility of the patients. However, after this application, there was no change in the patients' exercise capacity. It may be challenging to carry out the study with a large number of patients, and only 10 patients were able to apply the entire protocol.[26]

In 2019, Yuen et al[27], the study conducted by IPF to evaluate the compliance and effectiveness of a home-based exercise game program for IPF patients, the Wii Fit exergame program was applied for 12 weeks, 3 days a week for 30 minutes, and the Wii video game program was applied to the control group. The participants in the video game control group differed from those in the exergame intervention group was not having the Wii U Balance Board. The home-based exercise game intervention for patients with IPF showed no improvement in functional performance, shortness of breath, or health-related quality of life at the end of the 12-week program in either of the 2 heterogeneous groups. In addition to the following low rate, insufficient frequency and duration of exercise games were thought to contribute to the lack of improvement.[27]

Three studies included in the research examined the effect of home-based exercise programs on respiratory function parameters. In a study in which long-term follow-up was carried out that included deep breathing exercises, it was observed that the respiratory functions of the patients improved.[21] It has been shown in the literature that breathing exercises are effective on dyspnea and quality of life.[28] In a case study with long-term follow-up conducted by Naranjo-Orellana and Santalla[29] in 2020, it was reported that a supervised and systematic rehabilitation program, including inspiratory muscle training, could effectively improve functional performance and quality of life for IPF patients. In another study conducted in 2008 to evaluate the effectiveness of inspiratory muscle training in IPF patients, it was shown that adding this training to the pulmonary rehabilitation program was also effective on pulmonary function tests. However, no other study evaluating the effectiveness of deep breathing exercises in IPF patients could be found.[30] Pulmonary function test results were also evaluated in studies that included telerehabilitation and walking bicycle applications, but no change was observed.[24] The reason for this situation may be related to the compliance problem and non-use of the walking bike. In the telerehabilitation study, there was no improvement in pulmonary function parameters, but the current status of the patients was preserved.[22] Since IPF is a progressive disease, the preservation of the patient's current respiratory parameters shows the effectiveness of the therapy method.

In all of the studies included in this review, 6MWT was used to evaluate exercise capacity and walking distance. This test is simple to use in individuals with cardiopulmonary disease and provides information about the patient's exercise limitation. It is strongly correlated with the increased risk of hospitalization and mortality.[31] Previous studies in the literature have shown that 6MWT is a valid and useful tool for the management of patients with IPF.[32] In the study of Yuen et al[27], 6MWT data of the Wii exergame group deteriorated over time. However, when the investigation is examined, it is a low value that the patients' compliance with the program is 20%. Idiopathic pulmonary fibrosis is a progressive disease, and if the exercise program is not done regularly, it is possible result that its effectiveness will not be seen. In the

study of Shen et al[23], it was shown that home-based deep breathing exercises increase exercise capacity and walking distance in IPF patients. Leelarungrayub et al[33] The results of this study support Shen et al's[23] study, although it is a different group of pulmonary diseases. When we evaluated other studies included in this review, it was seen that there was no change in 6MWT results in general. This shows that a home-based exercise program is effective in a progressive disease such as IPF.

In all the studies included in the research, the quality of life assessment of the patients was assessed through questionnaires. In 3 of the 5 studies we reviewed, it was reported that there was an increase in the patients' quality of life after home-based rehabilitation practices. It has been shown in the literature that pulmonary rehabilitation practices increase the quality of life of patients, which supports the literature.[34,35] In the study that included the Wii exergame, it was observed that the patients' quality of life decreased. This situation may be associated with low compliance with the study. In the study that included telerehabilitation, there was no change in the quality of life parameters of the patients.

When the general results were examined, it was seen that the patients progressed in various areas compared to other studies in the study that included deep breathing exercises.[21] One of the reasons for this may be that the study was conducted for 12 months, longer than other studies. Another reason may be that the patient has a video recording they can use as a supervisor while exercising daily in the study of Shen et al.[23] Further studies in this area are needed to understand the cause.

When the study results were examined, it was thought that the adaptation and continuity to the home-based programs were low in general.[23-25] To increase the effectiveness of rehabilitation in home-based programs and to ensure patient compliance, follow-up programs and supervision should be well done. The reason for the low patient compliance may be inadequate follow-up programs or the supervision method. In the studies within this review, exercise diaries were given to all patients for follow-up, and the patients were supervised with different methods. In studies where follow-up was done by telephone, it was observed that compliance problems were more common.[23,25] Although compliance is high in telerehabilitation practice, there has been no improvement in outcomes in most areas. This may be due to patient differences.

In addition, when the studies were evaluated, it was thought that the results were not as expected because the patients did not comply with the study protocol in the rehabilitation programs applied at home using a material (Wii game console, NMES device, walking bike).[23-25] Device-specific reasons, such as patients not wanting to use the walking bike for social reasons or encountering the side effects of NMES application while applying it at home may cause this situation.

CONCLUSION

As a result, home-based rehabilitation approaches can be applied, especially for IPF patients who have difficulty accessing rehabilitation practices during the pandemic period, who have the risk of infection, and who do not want or cannot go to the hospital for rehabilitation services. However, continuity is essential for the benefit of patients. Appropriate supervision methods should be preferred, and patient follow-up should be done to ensure the sustainability of the program and patient continuity. In addition, the literature on the effectiveness of home-based exercise programs in IPF patients is weak and more publications are needed by practicing different rehabilitation methods and study protocols.

There are many limitations in this review. First of all, the fact that we used a single database while conducting research shows that we have done limited research in the literature. As a result of the examination, according to the inclusion and exclusion criteria in the review, a total of 5 studies were included. The small number of these is one of the limitations of the research. We believe that the inclusion of studies conducted in the last 5 years has caused this situation. First of all, the reason why we used the studies from the last 5 years in the study is that we want to present the current literature. In addition, studies with home rehabilitation in rare diseases such as IPF in the literature before the coronavirus disease-2019 pandemic are very limited. However, the use of a different home-based rehabilitation application in all the studies we included in the review was a disadvantage in terms of combining and supporting the results. Thanks to this situation, we had the opportunity to compare the effects of different home-based approaches on the same parameters. Another limitation is the heterogeneity of the patient groups in the included studies and the insufficient numbers. The lack of literature in this area and the inadequacy of studies on home-based exercises in IPF patients may be the reason for this situation. One of the limitations of the research is that one of the randomized controlled studies we included in the review was in a crossover design. Our reason for inclusion is that the study focuses on a different home-based rehabilitation approach.

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